Acrel
PHEV Conversion Kit User Manual

For 2004-2009 Prius

Warning:

You are strongly recommended to have a qualified professional to undertake this installation!

High Voltage (HV) Direct Current (DC) Warning: Traction battery packs, motors, chargers, and other HVsources could cause serious injury or death if proper precautions are not taken while working on or around such high voltage direct current sources.

Please note that anyone attempting to install this conversion kit and modify their vehicle is doing so at their own discretion and risk.

Warranty: In performing some of these modifications it is possible though unlikely, to void your warranty with the vehicles manufacturer. Please check with your original vehicle manufacturer / dealer for confirmation.

This is a patent pending technology.

Driving Techniques for Maximizing Acrel Prius PHEV Mileage:

1. Maintain steady speed as frequently as you can;

2. When attaining the speed you desire on the road, feather the accelerator or lifting your foot off entirely, then very lightly easing back in to maintain a steady speed of under 34 miles or 70km per hour. That motion activates your Prius EV feature that merely consumes stock and Acrel batteries.

*Tests in this driving style on Acrel Prius PHEV have shown way better than 100MPG or 100KM/2.83L, with the best factory field test outcome of 160MPG or 100KM/1.7L for accumulated test drive distance of 165KM.

Attention

1. Please read instructions before installation.

2. Never connect wires improperly. Do recheck wires at least 3 times before switch on power.

3. New batteries should be re-charged to full and balanced before driving.

4. Please check the batteries' voltages and balance regularly for the first few times you drive the vehicle.

5. To extend battery life, equipment must be recharged, especially when it will not be used for over one week, using the **110VAC** (for USA or the right voltage in other countries, watching the label on **Acrel** charger.) household electricity powered charger provided, to full each time and the cells need to be fully balanced after charging.

6. The circuit breaker on the right hand side of the enclosure box is set to be switched off automatically if the current exceeds a pre-set limit (125A). In the event this breaker switches off you will then need to manually switch it back on before use.

7. Please switch the equipment off immediately if damage or defect is found.

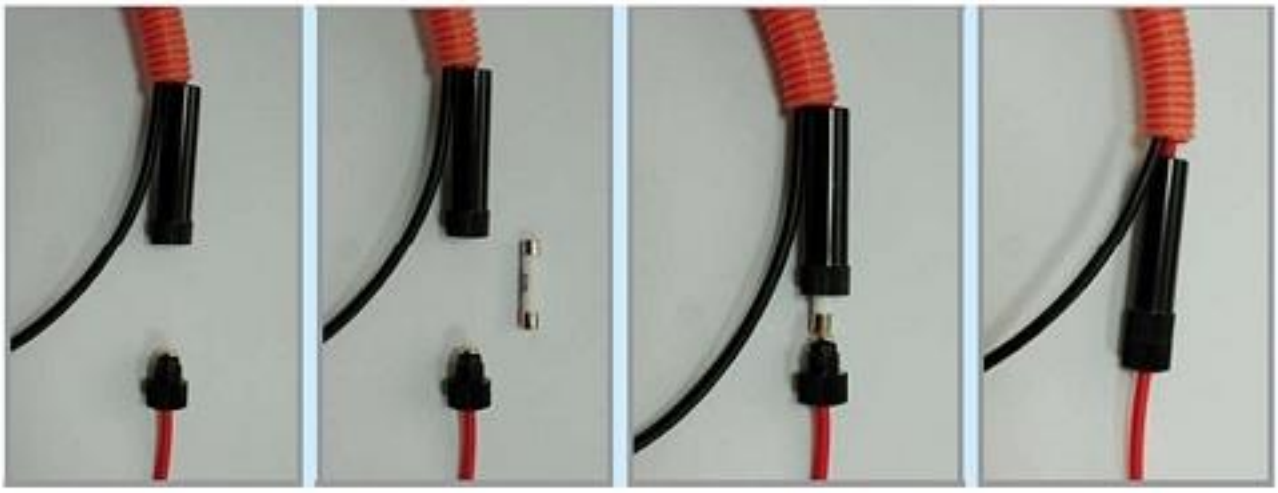
8. Please do not disassemble the components if the equipment is working normally, and if you are not a qualified professional.

9. Please disconnect BMS to batteries if not used for over 10 days to avoid battery failure.

10. You can replace the charger and converter fuse if there is some problem.

A. Charger fuse: The fuse block of the charger is inserted into the AC plug. You can use a flat screw driver to pivot the block in the middle edge, above the fuse sign and pull it outward.

B. Converter fuse: The fuse block is connected to the high voltage wire. You can open the block by hand and replace the fuse.



Product Overview

The Acrel Plug-in Hybrid Electric Vehicle Conversion Kit (PHEV) is a rechargeable battery set that is supplementary to Prius OEM battery. It supplies electricity which is charged from an AC wall socket, stored in PHEV kit providing for 40 miles of electrically assisted driving per charge, sufficient for most normal daily commutes. It is safe, reliable and user and environment friendly.

What is Included in this Product

4KWH Lithium-Ion batteries

BMS - monitoring and balancing battery voltages to avoid over or under charges to individual cells. This can extend battery life by a factor of 3.

110VAC - 48VDC / 15A high power charger

4000W DC / DC converter and controller

Fire extinguisher will be activated once the inside temperature exceeds 221F—First of all, please remove the cover and pull out the blue insulative inserter.

Automatic DC circuit breaker—to disconnect high voltage equipment operation in the event of a high current fault.

Steel enclosure.

How the System Works

110VAC (USA) household electricity → Acrel PHEV conversion kit → OEM stock battery → Prius electric motor

Batteries	Type	Capacity	Average Gas Mileage	EV/Mixed Range	Charge time
	Lithium-ion	80 AH	85mpg	20 (40)	5 hours

Use 110V AC source (USA), or other AC source matching PHEV charger) only.

Warranty

Two-year limited parts warranty applies. If equipment defect occurs in normal use conditions, **Acrel** shall repair the equipment or change the defective component in this conversion kit only.

Use this information at your own risk: Other than as specified above there is no additional warranty expressed nor implied and Acrel shall not be liable for any of your past, present, nor future actions. Even if you perform these modifications to the letter you could still damage any number of components in your vehicle causing it to no longer function. Even if it appears to function properly your actions may cause it to self-destruct with collateral damage to surrounding properties other you're your vehicle. By utilizing these ideas and instructions in an attempt to enhance national security, reduce gas consumption, vehicle "emissions", your carbon footprint, or smog, you do so at your own risk & peril.

Preparing and Assembling the PHEV Conversion Kit

Please carefully read and understand these instructions before opening the product box.

Installation and Use

1. Prepare a flat area of at least a 7x7 feet on the ground near the end of your Prius, and cover the floor with 5x5 feet soft and flat cloth or cardboard.

2. The equipment is heavy and should be removed and handled by at least two adults. As industry standard it is suggested that the system should be lift by lifting machine.

3. Knock open the wooden box, if there is one, and then open the cardboard box in-side.

4. Take out accessories and place them in a place not impeding your later installation. Take out the foam plastic cover from the cardboard box and pull out the steel box, this requires at least two people with both hands, carefully and steadily move out the entire steel box and place it gently on the floor. Do not tilt or turn over the equipment.

5. The equipment weights about 165 lbs. **Acrel** strongly suggests you use professional lifting equipment, or operators that are strong enough to lift this much weight. Slowly handle the equipment to avoid physical injury or equipment damage.

6. After popping up the cover firmly and checking that it is being safe with no risk of dropping down, take out all insulating foam gently and check inside component and accessory bags against the following list:

- ECU signal wires (green, brown and white)
- One switch panel with on/off switch, red and green LED lights
- 6 pin phone wire
- Converter high voltage core (red and black core with blue bullet connectors)
- Power core for charger input
- 2 sets of equipment mounting screws (size M8)
- One charger input bumper socket
- One double-sized spanner
- One thread for converter and charger
- 4pcs plastic clamps for connecting ECU signal wires to Prius
- Two black rubber blankets, longer one for left hand side, shorter one for the right hand side.
- One 50cm long vent pipe for left hand size corner ventilation fan
- 1:1 mounting hole positions template.
- Stainless steel box and cover (833 x 505.5 x 152mm)
- Batteries: 2 packs (4KWH). Please make sure batteries match your order.
- One converter mounted back left, connecting batteries with one red and one black power inlet wires with a pair of Anderson plug. It also contains one red and one black power outlet, and a 6 pin cable.
- One charger mounted on right back connecting black power inlet cable, with left hand side one red and one black cable with an Anderson plug.
- BMS fixed upon the charger(the side close to your body).
- Two ventilation fan fixed on the converter at left corner.
- One circuit breaker mounted on top of charger.
- One fire extinguisher is fixed at the middle of the box, on batteries.

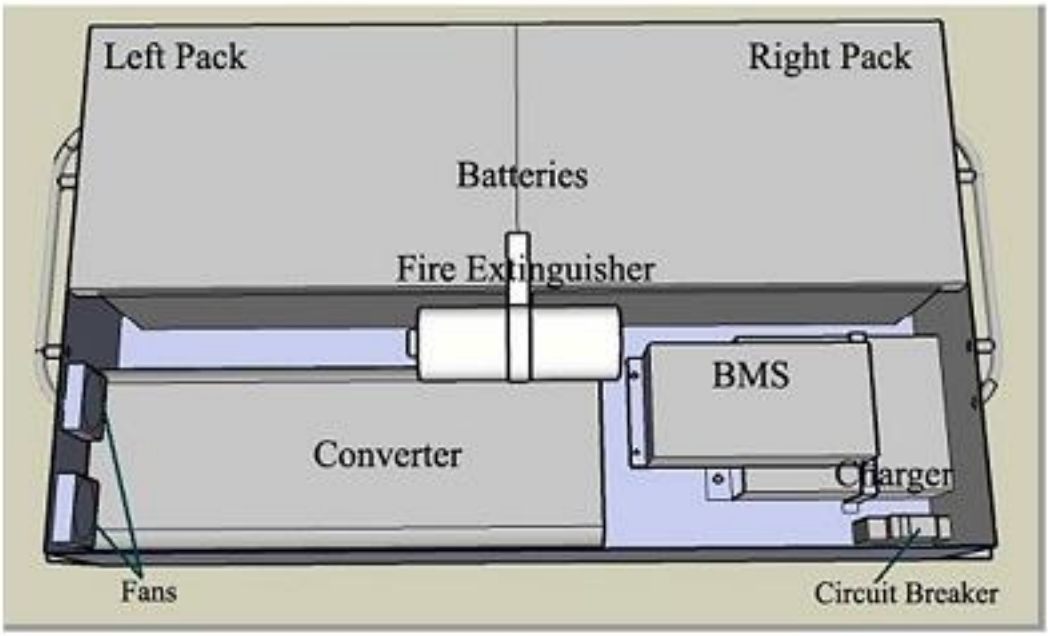


Figure 1: Component Layout

7. Wiring Check:
   ①Make sure circuit breaker is in the OFF position, BMS' interfaces off;
   ②Charger and converter connections are connected firmly;
   ③Connection between black wires from batteries and circuit breaker are connected firmly and correctly as shown follow.

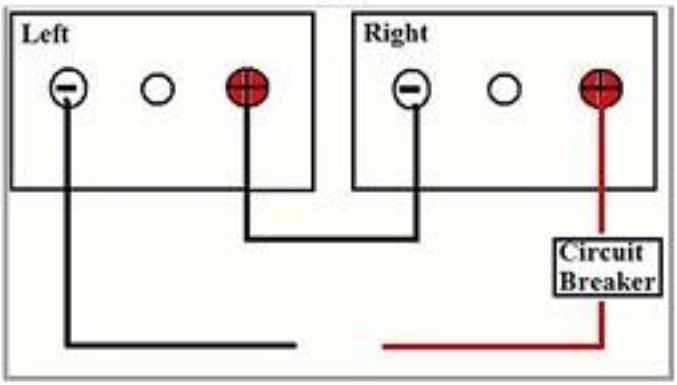


Figure 2: Connection of batteries (4KWH)

8. Wiring:
   ①Connect two pair Anderson plugs to batteries, should be "**R**" to "**R**" and "**L**" to "**L**",
   "R" means Right pack and "L" means Left pack;
   ②Connect the two 9 pins and two 4 pins white connectors to the BMS, also should be "**R**' to "**R**" and "**L**" to "**L**";
   ③Then connect the 8 pin wire to BMS;
   ④Connect the high voltage core(red and black core with blue bullet connectors) to the converter output connectors;
   ⑤Connect the 6 pin phone wire to the converter;

9. The conversion kit assemble is completed and ready to be installed into the vehicle.

10. Bumper outlet for charger connection. Black wire: Live line (L); White wire: Null Line (N); Green wire: Ground Line (E). Take the wire of charger through the back panel and reach to bumper outlet. You need to get your hand in from under the car and tighten the silver ring of bumper plug.

11. Install Charger's LED into the tail-light, this LED shows the performance of Charger:
Red on: Charge by about15A.
Green on: Fully charged.

12. PHEV switch panel operation:
ON：Turn on PHEV DC/DC Converter (LED Green---On; Red—Battery Low)
OFF：Turn off PHEV DC/DC Converter (LED Green-- Off)

Connecting Acrel PHEV Conversion Kit to your Prius

Installation Time: 1 hour by professionals.

Before installation, please be advised to login to Toyota Technical Website ***techinfo.toyota.com*** for Reference Instructions. ($15 for two day usage as of June 2009)

Preparation tools Required:

Screw shell M6~M14

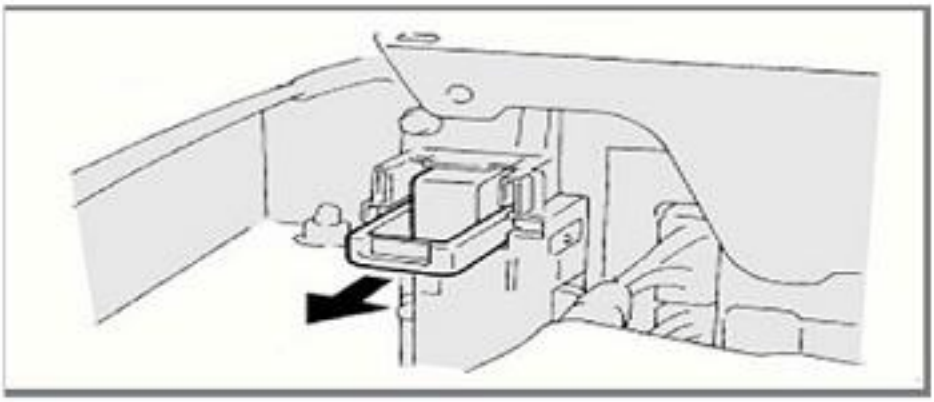
Crosshead screwdriver

Electric drill

Installation Procedure:

1. Stop your Prius engine completely by taking away your car key.

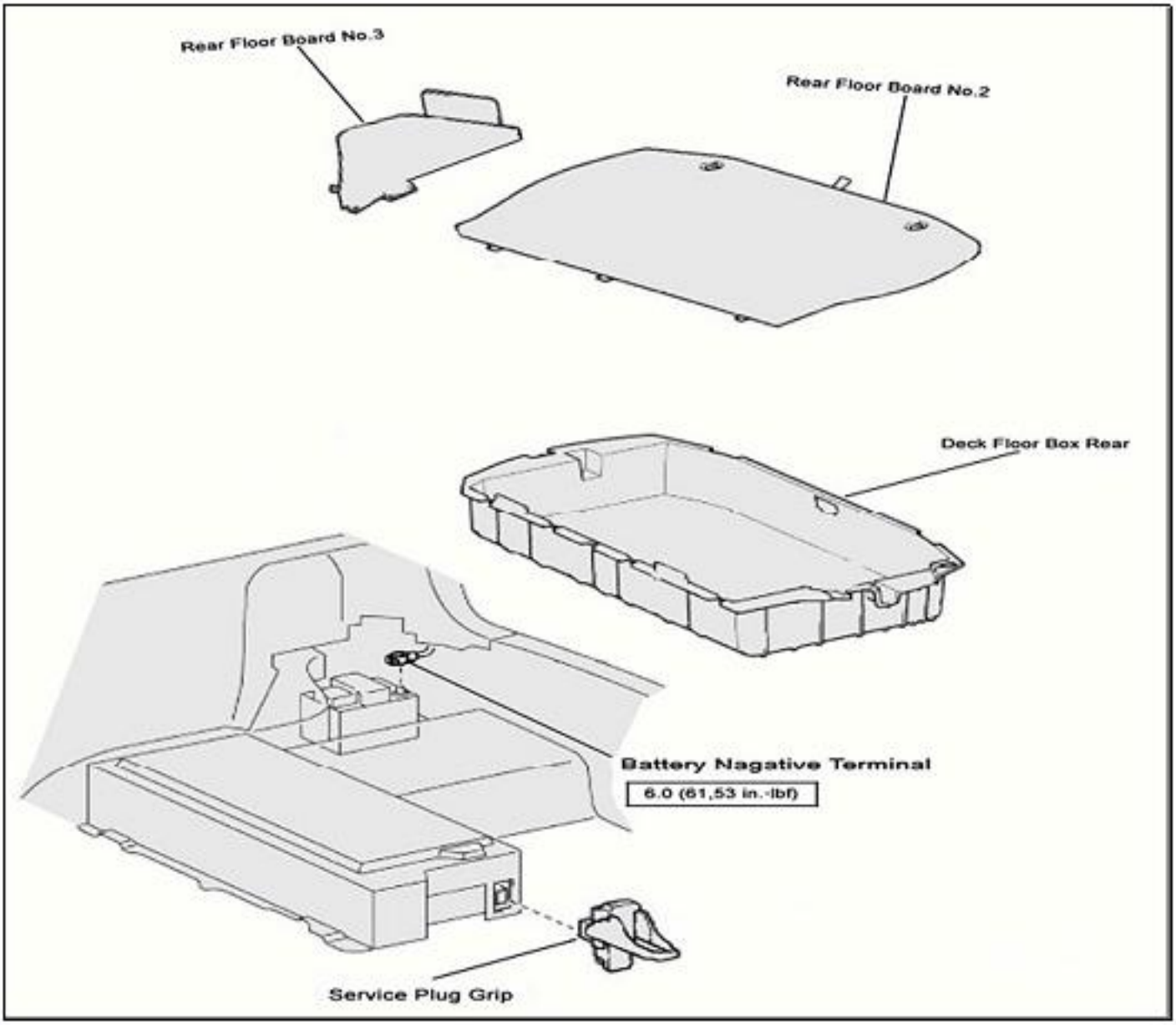
2. Remove trunk interior cover on the back of the back seat to gain access to OEM stock battery orange service plug and unplug it.

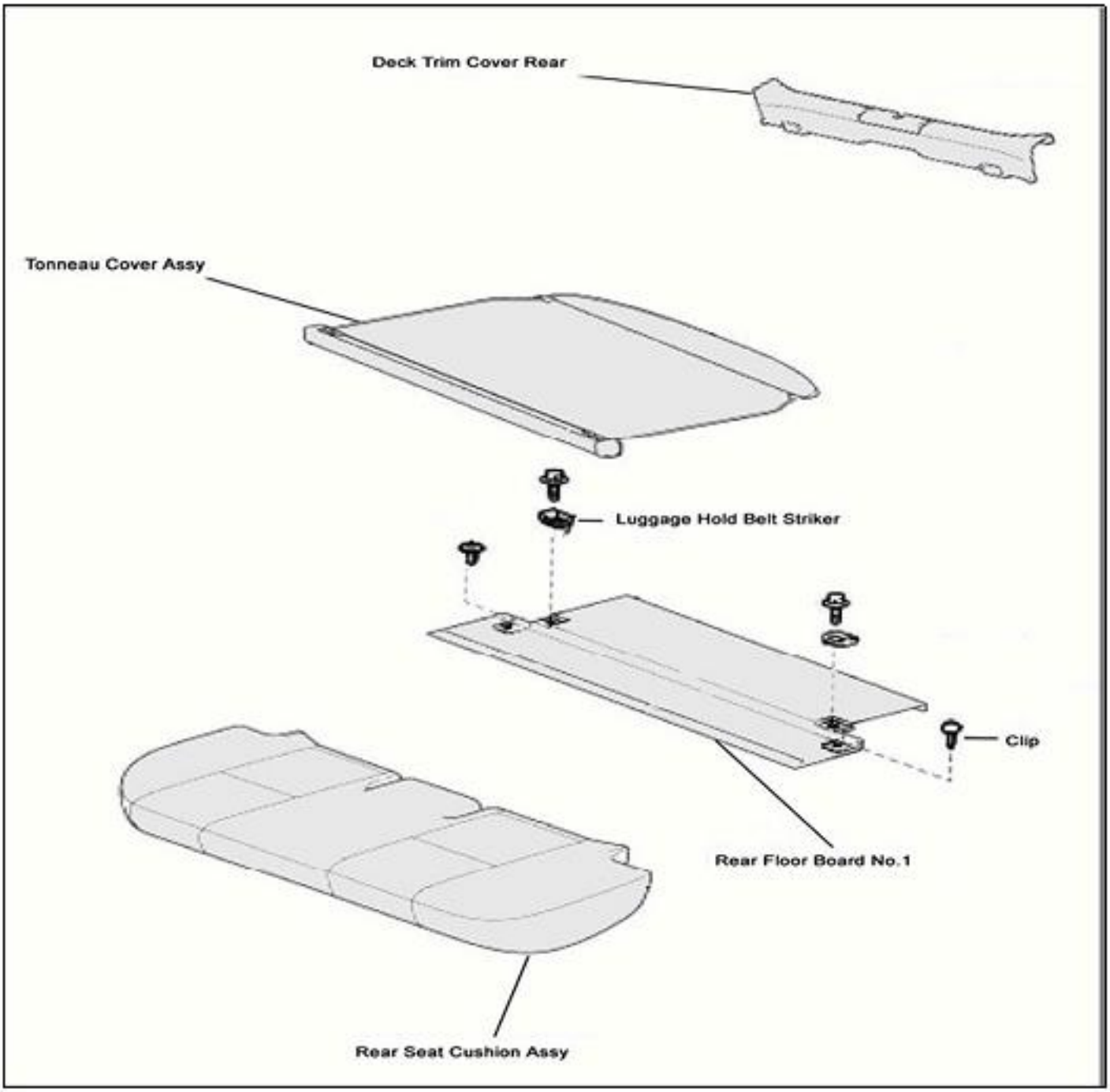


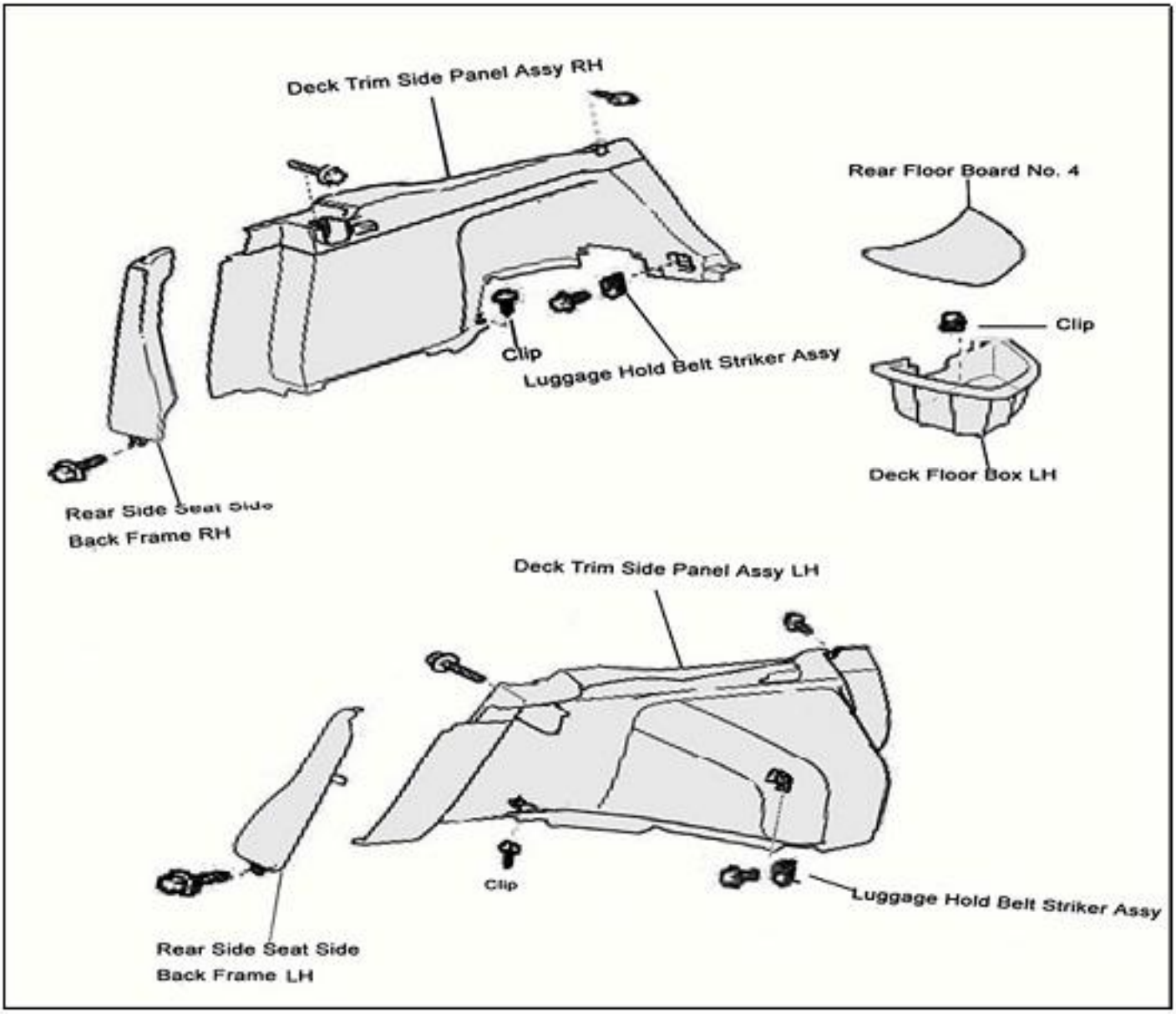
3. Remove auxiliary battery negative terminal.

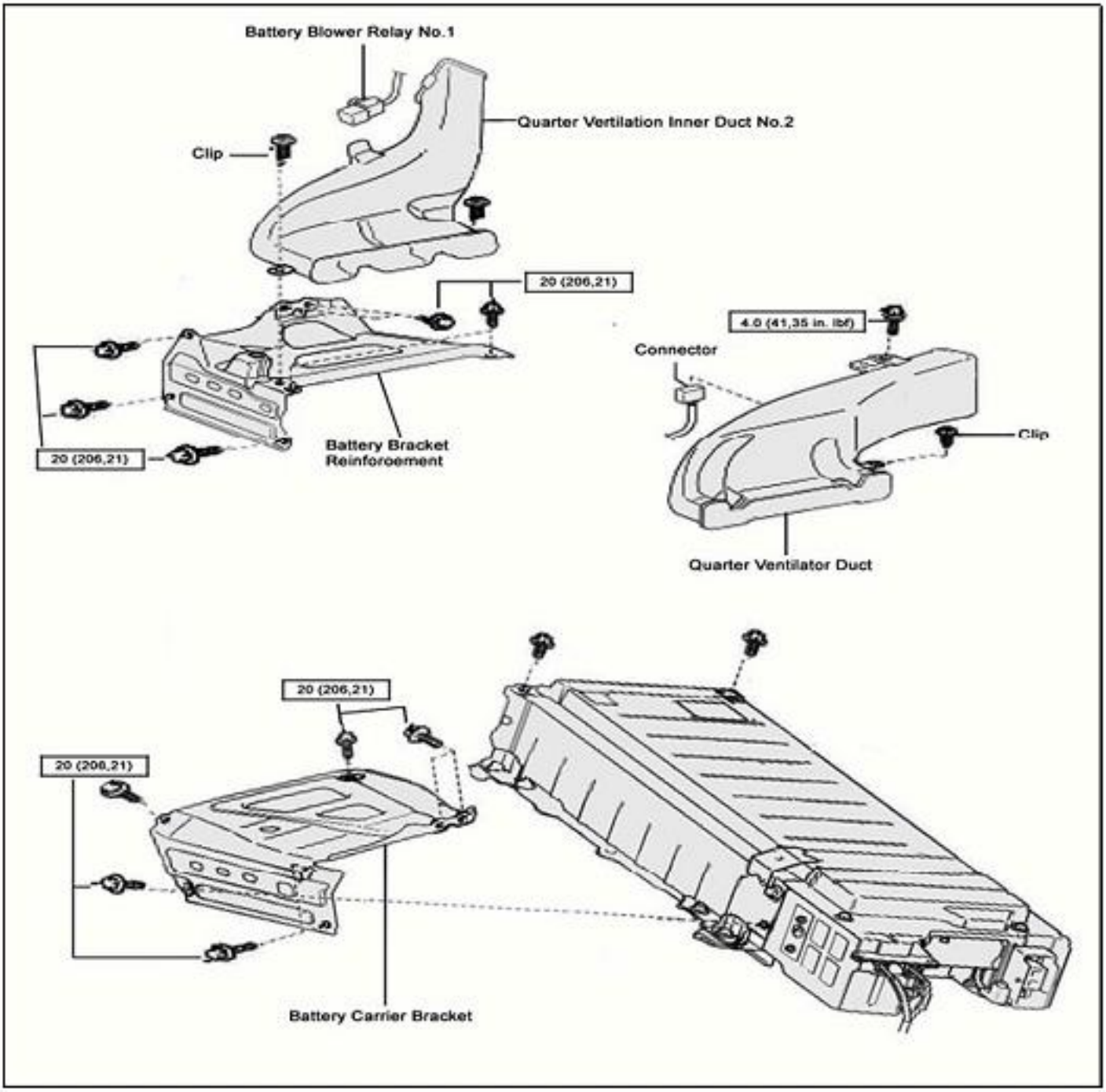
4. Remove back seat and gain access to the OEM stock battery output terminals.

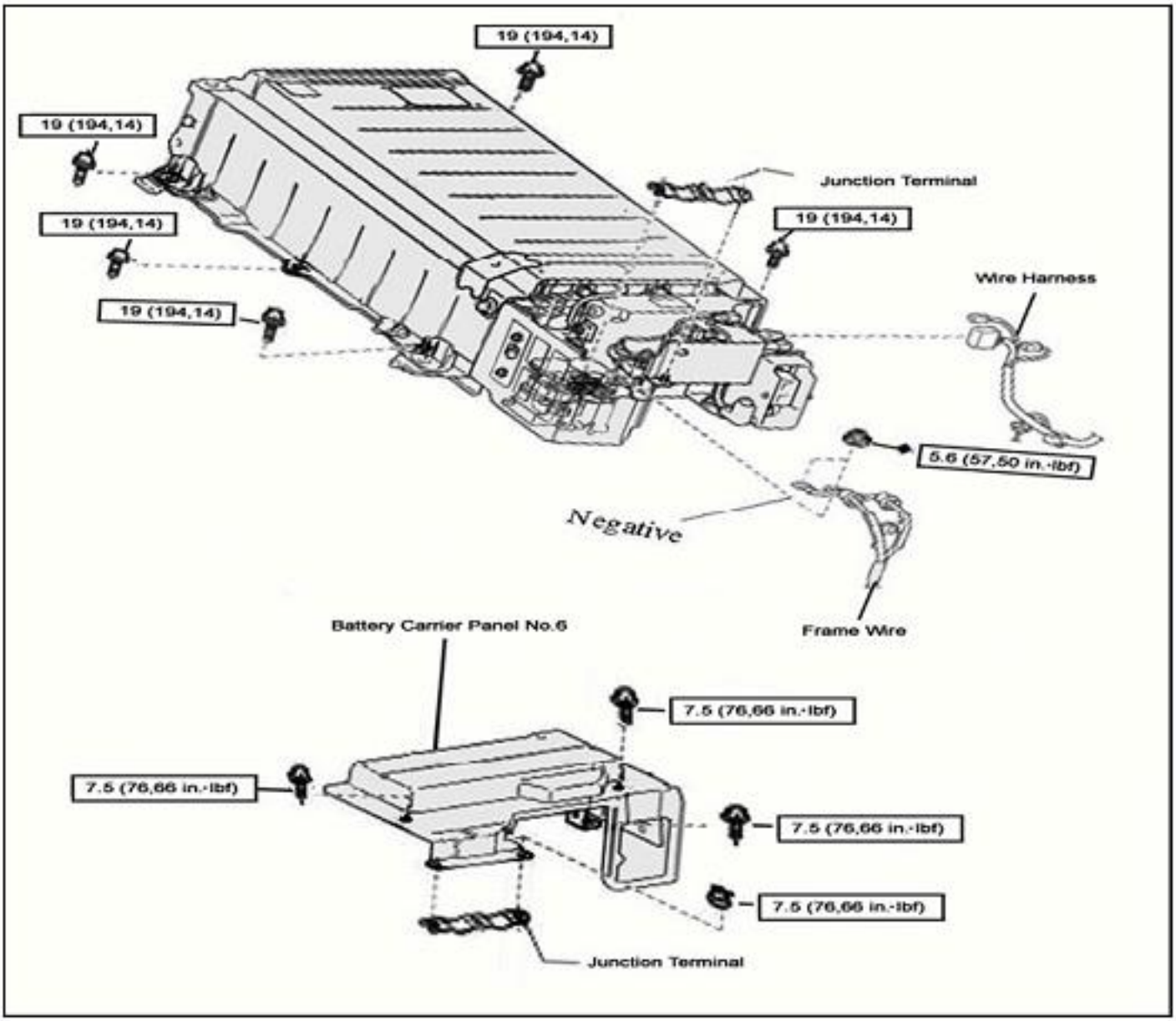
Reference: 21-54 HYBRID CONTROL SYSTEM – HV BATTERY (for 2004-2009 Prius)




Deck Trim Cover Rear
Tonneau Cover Assy
Luggage Hold Belt Striker
Clip
Rear Floor Board No.1
Rear Seat Cushion Assy


Deck Trim Side Panel Assy RH
Rear Floor Board No. 4
Clip
Clip
Luggage Hold Belt Striker Assy
Deck Floor Box LH
Rear Side Seat Side
Back Frame RH
Deck Trim Side Panel Assy LH
Clip
Luggage Hold Belt Striker Assy
Rear Side Seat Side
Back Frame LH


Battery Blower Relay No.1
Quarter Vertilation Inner Duct No.2
Clip
20 (206,21)
20 (206,21)
Battery Bracket
Reinforcement
4.0 (41,35 in. lbf)
Connector
Clip
Quarter Ventilator Duct
20 (206,21)
20 (206,21)
Battery Carrier Bracket



5. Connect the conversion kit's power cable to positive and negative terminals of the stock battery output power cable.

6. Install on/off switch panel.

A. Take off the blank panel on the left hand side of your meter board

B. Loosen the switch bolt, place it on through the panel hole and tighten it on the panel.

Before replace panel:

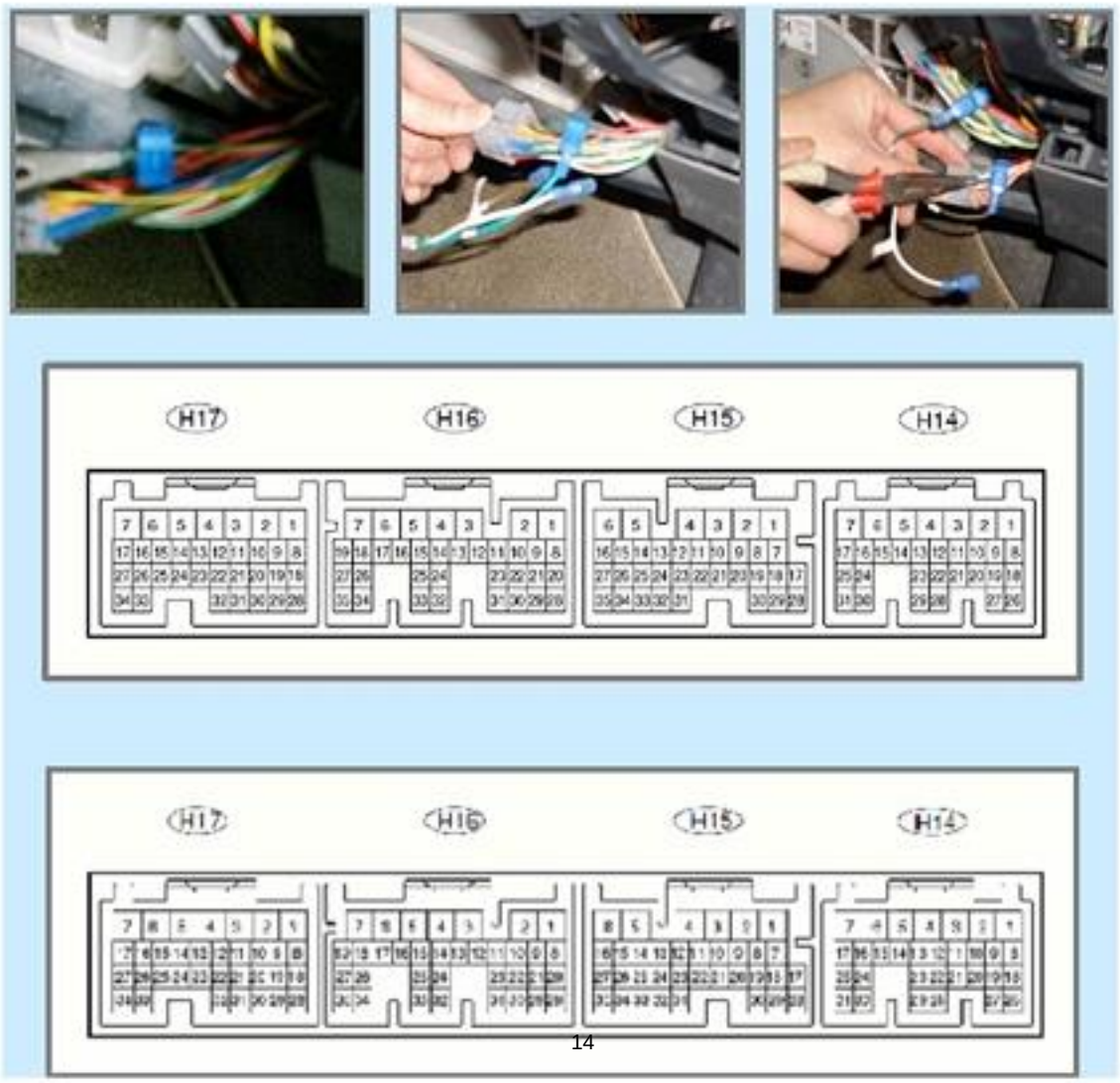
After replace panel:

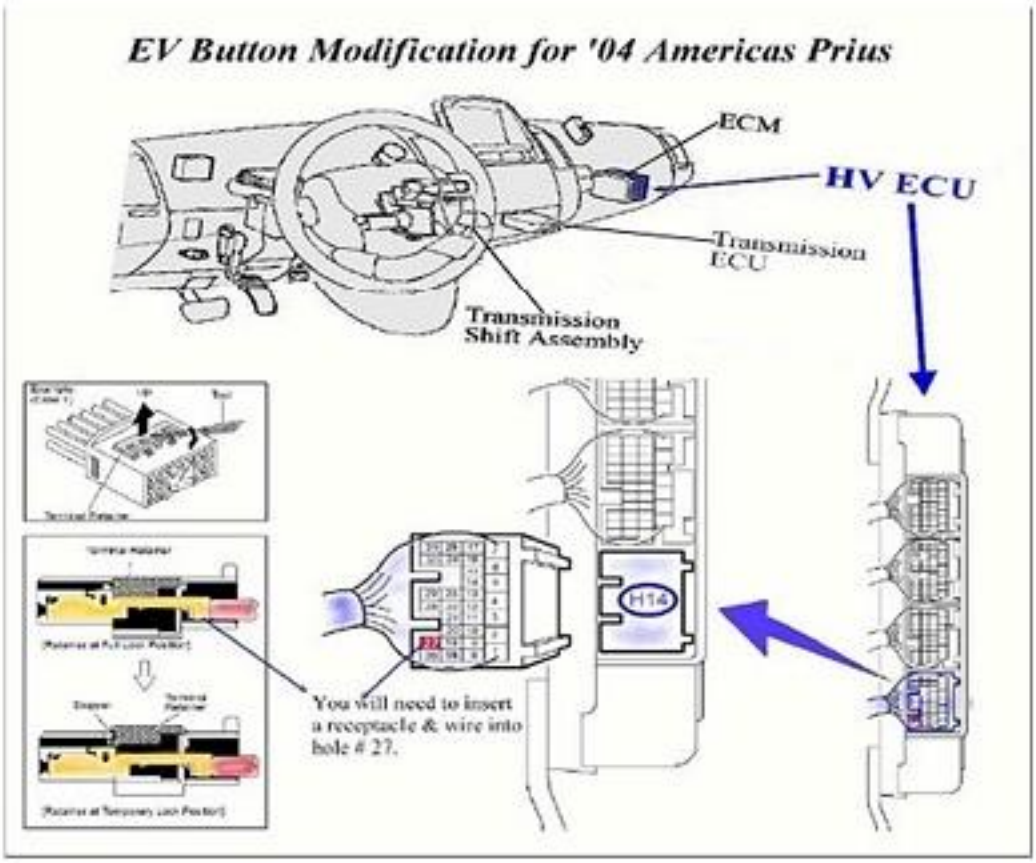
7. Hook up ECU Ignition Ready signal to on/off switch panel.

Reference: 05-408 DIAGNOSTICS – HYBRID CONTROL SYSTEM (for 2004-2009 Prius)

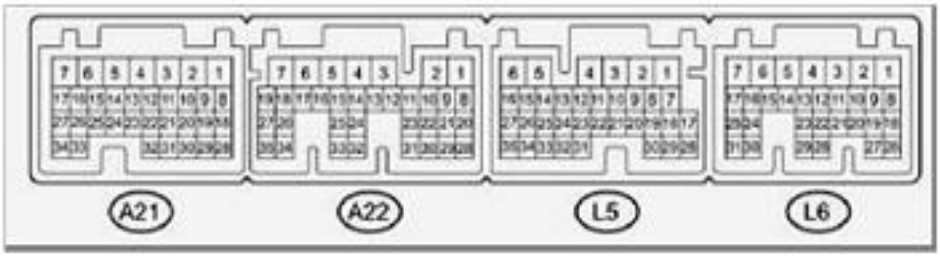
CON2 (H16–2) - Green: Ignition Ready (Connect to the Green wire of PHEV switch panel)

GND1 (H14–1) - White-Black: Ground (Connect to the Brown wire of PHEV switch panel)




EV Button Modification for '04 Americas Prius
ECM
HV ECU
Transmission ECU
Transmission Shift Assembly
H14
You will need to insert a receptacle & wire into hole # 27.

Power Management Control ECU



8. Hookup 6-Pin on/off switch panel cable to your **Acrel** battery box.

9. Drill a hole and mount Bumper AC Outlet

10. Re-Install back seat and trunk panels. Reposition tightly Service Plug Grip, otherwise electric power cannot be started.

Your Acrel PHEV Conversion Kit installation is now complete.

Please test the equipment in the following steps:

1. Turn the Acrel circuit breaker off.

2. Disconnect the converter high voltage output to the OEM battery (red and black wires with blue bullet connectors).

3. Turn on the car.

4. If the car can't start and has check engine light, do step 5-8.

5. Check Toyota battery orange high voltage service plug to make sure it is plug in correctly and secured.

6. Check splice wires to make sure the connectivity is not compromised and the wire is correct. Sometime, the splice could cut off the original wire.

7. Use scan tool to reset error code or disconnect the 12V battery and wait for 15 minutes to reset the error code.

8. Re-check the car to make sure it is operational.

9. Turn on Acrel circuit breaker. But keep HV output wires disconnected.

10. Turn on the car.

11. Check if only the green light on Acrel PHEV switch panel is on when the switch is ON. Also check the light on the converter output panel in the battery box.

12. If the green light is not on, use a meter to check if the Ignition 12V signal is 12V on the PHEV switch panel. Also check the phone cable connector on the converter side to make sure pin 5,6 has 12V signal.

13. Check OEM battery high voltage. Play attention to the polarity of the wire.

14. Check PHEV converter output high voltage. Play attention to the polarity. The voltage should be higher (5-10V higher) than the OEM battery voltage.

15. Turn off the car, connect converter high voltage to the OEM battery.

16. Turn on the car in Park, check PHEV battery voltage, it should drop 1-5V when it charges the OEM battery.

17. If the PHEV voltage drops more than 5 volt, check the individual cell voltages to see if any cell is weak and significantly lower than the peer.

18. Charging batteries.

19. Wait overnight for the cell to be balanced.

At last, Mount your Acrel PHEV Conversion Kit:

A. Mark eight mounting holes according to size and dimension of the Kit's mounting brackets. Remove one screw on the right side of truck avoiding bumping against brackets.

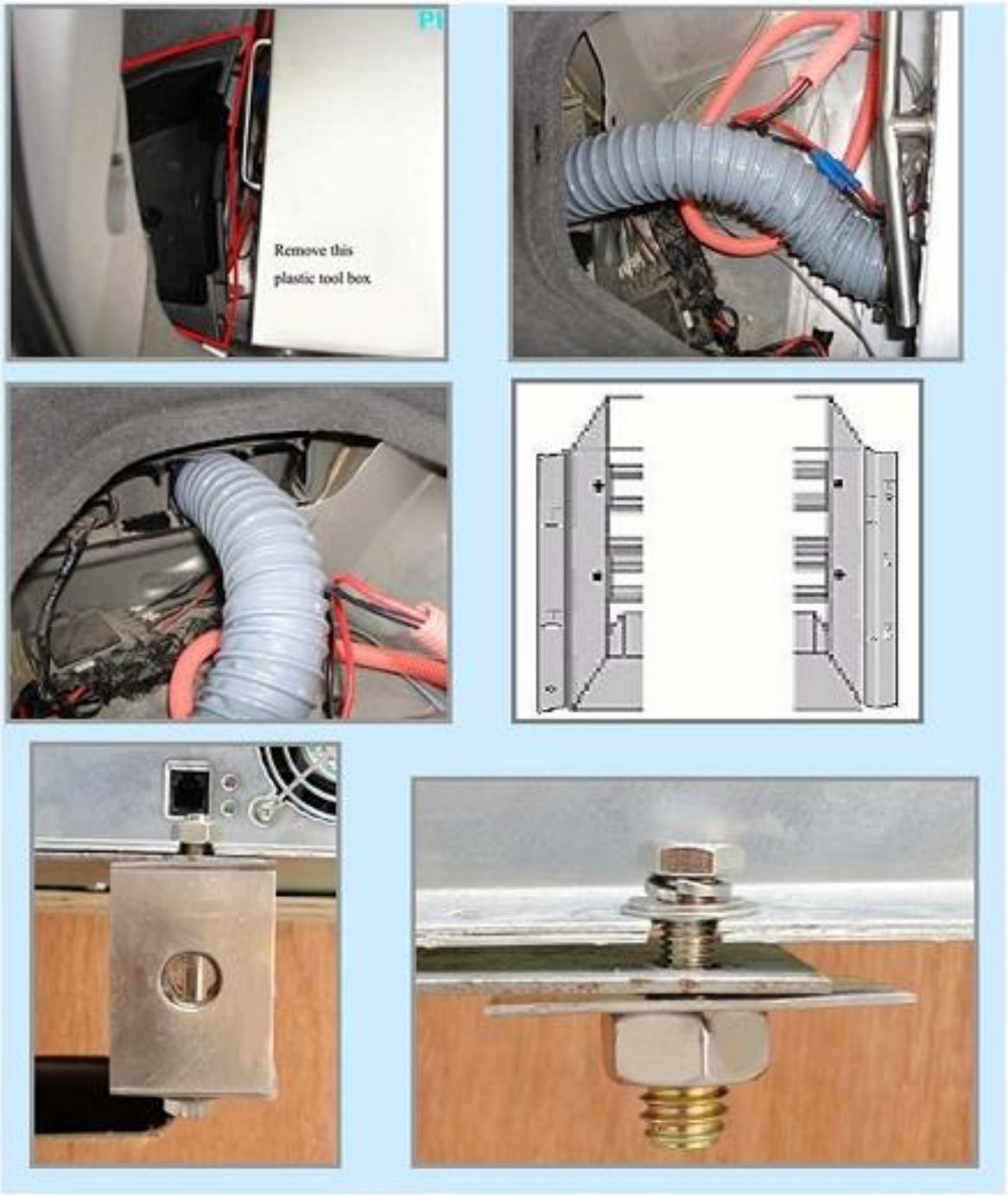
B. Drill eight 13mm holes on the truck floor plate.

C. Put the rubber blankets under the brackets (the long one for left bracket, the short one for the end of right bracket).

D. Tighten eight mounting screws with washer and spring ring.

E. Remove implements on the left side of trunk and put the vent pipe for circulating air inside PHEV.

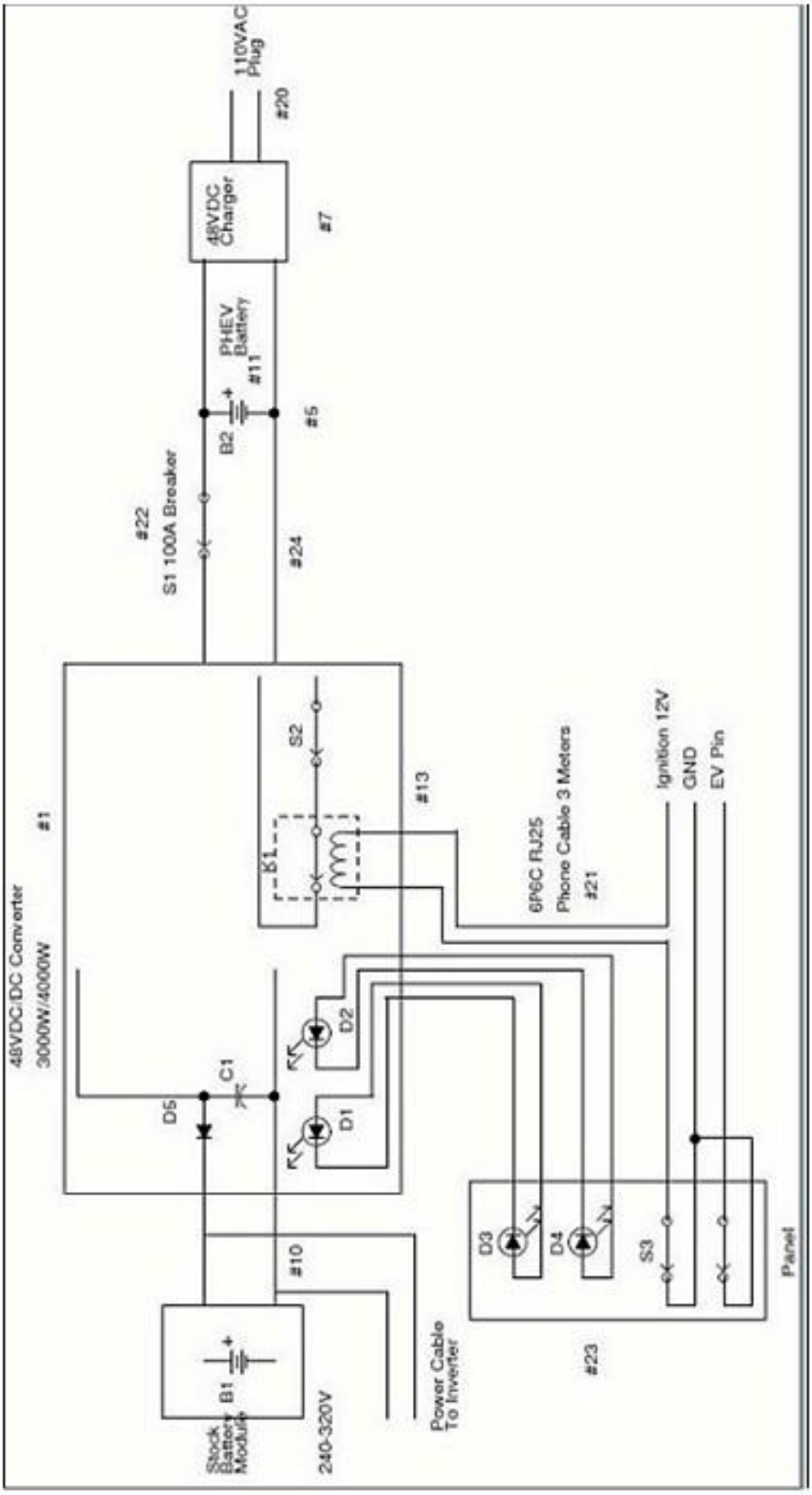
F. Then you may tighten buckles on two sides of the enclosure box to mount the entire equipment.



Once all the above steps are completed and no defect occurs, so tighten two screws on both sides of the steel lid, you are now safe to drive your Acrel Plug-in Hybrid Electric Vehicle!

Acrel very much appreciates your effort to save the earth

and wishes you enjoy your driving with your PHEV.


110VAC Plug
#20
48VDC Charger
#7
PHEV Battery
#11
B2
#5
#22
S1 100A Breaker
#24
48VDC/DC Converter
3000W/4000W
#1
S2
K1
#13
6P6C RJ25
Phone Cable 3 Meters
#21
Ignition 12V
GND
EV Pin
D2
C1
D5
D1
D3
D4
S3
Panel
#10
#23
B1
Stock Battery Module
240-320V
Power Cable To Inverter

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